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Article

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Gender differences in Type 1 credit rationing of small businesses in the US

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Abstract: This paper explores Type 1 credit rationing by gender using data from the 1998 and 2003 Survey of Small Business Finances (SSBF). Type 1 credit rationing occurs when borrowers receive a smaller loan than they requested. We use two measures of Type 1 credit rationing to examine whether it is related to gender discrimination in lending. Our results show that women business owners are not likely to be Type 1 rationed. However, newer female-owned firms receive significantly lower loan amounts than requested compared to their male-owned counterparts. We also find that less experienced women receive significantly lower loan amounts compared to less experienced men.

Subjects: Credit & Credit Institutions; Entrepreneurial Finance; Entrepreneurship; Feminist Theory; Gender Inequality; Gender Studies - Soc Sci; Small Business Management; Women's Studies

Keywords: small business finances; women entrepreneurs; female-owned businesses; perceptions of gender discrimination

1. Introduction

Women-owned small businesses play an important role in the economy. However, their representation among business ownership still lag behind all firms (Minniti, 2009). Women-owned businesses in the US represent "only 3.5% of total sales, 6.4% of total employment, and 4.5% of annual payroll" in 2007 (Coleman & Robb, 2012, p. 5). Despite this fact, the number of women-owned firms increased

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Naranchimeg Mijid is an assistant professor of Economics at Central Connecticut State University. Her main research areas include small business finances, gender and racial discrimination in lending, and women and minority entrepreneurship. Her latest articles are published in the *Journal of Small Business and Entrepreneurship (JSBE)*—forthcoming, Social *Science Journal (SSJ), Review of Social Economy (RSE),* and *Derivatives, Use and Trade Regulations (DUTR)*. She is a contributor and co-editor of the Kauffman Foundation's *State of the Field in Entrepreneurship,* a main website where researchers and non-academics can find the latest studies on various subtopics of the field of entrepreneurship. She is currently working on several studies related to small businesses in Connecticut and nationwide using the Kauffman Firm Survey.

PUBLIC INTEREST STATEMENT

Despite a rapid growth in numbers for women-owned firms in the US, their performances in terms of sales, assets, and employment fall short of their male-owned counterparts. Studies have explored whether their underperformance is related to their access to credit. However, there are limited studies on Type 1 credit rationing, which occurs when a borrower receives a smaller loan than they request. This paper fills the gap and explores Type 1 credit rationing by gender using the two Surveys of Small Business Finances. We use two measures of Type 1 rationing to examine whether there exists gender discrimination in lending. Our results show that women are not likely to be Type 1 rationed. However, when we looked at newer firms, women-owned firms receive significantly lower loan amounts than requested compared to men. We also find that less experienced women receive significantly lower loan amounts compared to less experienced men.

dramatically in recent years. For example, the latest Survey of Business Owners report shows that the number of female-owned firms increased by 20.1% between 2002 and 2007 whereas men-owned firms increased by 5.5% only[1].

Small business' success heavily depends on their access to credit, especially traditional bank loans (Williams & Ou, 2008). The US Small Business Small Business Administration (2003) report that examined financing patterns of small businesses found that over 80% of the firms in the survey report that they had outstanding debt, and 55% had traditional bank loans (Ou & Williams, 2003). Relationship between success of business and access to credit is more explicit for start-ups and their survival in subsequent years (Bates, Robb, & Parker, 2013; Fracassi, Garmaise, Kogan, & Natividad, 2013). This is especially true for women-owned businesses (Fairlie & Robb, 2009; Gatewood, Brush, Carter, Greene, & Hart, 2009) since they are more disadvantaged (Loscocco & Robinson, 1991).

Recent rapid growth in women-owned firms in the US[2] has attracted researchers to investigate these firms and issues related to gender of the business owners (Greene, Hart, Gatewood, Brush, & Carter, 2003). One specific issue is that despite this recent trend in the number of firms owned by women, their performance in terms of sales, assets, and number of employment is significantly lower than male-owned firms (Fairlie & Robb, 2009). Several studies examined reasons for their underperformance and have looked at differences in access to credit by gender and other demographic characteristics of the small business owner.

For example, Cavalluzzo, Cavalluzzo, and Wolken (2002) analyzed loan application rates, loan denial rates, unmet credit needs, and interest rates charged by gender, race, and ethnicity. Mitchell and Pearce (2005) examined loan denial rates by specific loan types (either by relationship loans or transaction loans) and by specific lender types (either by banks or non-banks). Cavalluzzo and Wolken (2005) explored the effect of personal wealth, such as homeownership, home equity, and personal net worth, on loan denial rates. Blanchflower, Levine, and Zimmerman (2003) examined relationship between credit rationing and discrimination to investigate loan denial rates and interest rates charged by banks across gender and demographic groups. Mijid and Bernasek (2013b) also examined whether credit rationing is a form of discrimination in the small business credit market using a model that includes discouraged borrowers and found that women owners ration themselves rather than rationed by banks.

The above studies find mixed evidences and contradicting results about whether women owners are credit constrained by banks. The key findings suggest that the reasons why women business owners are subject to credit rationing are related to the firm-specific characteristics but not gender of the owner (Robb, Wolken, & Board of Governors of the Federal Reserve System, 2002). Women owners might not have enough collateral and/or develop relationship with their financial institutions since their firms are newer, smaller, more risky, or less attractive to banks. As a result, they are more discouraged to apply for bank loans and stay smaller than men-owned firms (Mijid, 2015). This raises a question: how women owners can obtain necessary capital in order to grow and succeed if indeed credit is rationed to those who don't have enough assets, collateral, equity, etc.?

Credit rationing has been viewed as the main reason for capital market imperfections caused by adverse selection and moral hazard problems (Stiglitz & Weiss, 1981). To avoid these information asymmetry problems, lenders ration borrowers in two ways: either by granting smaller loan amounts than requested, known as Type 1 rationing, or by declining the loan in its entirety, known as Type 2 rationing (Keeton, 1979). Most of the existing literature on credit rationing considers Type 2 rationing. For example, many studies examine whether or not credit rationing exists (Sealey, 1979), whether it is important phenomenon in the economy (Berger & Udell, 1992), who (what type of a borrower) is more likely to be rationed (Bopaiah, 1998; Freel, 2007; Jappelli, 1990), what determines credit rationing (Zeller, 1994), and how we mitigate the information asymmetry problem (Blumberg & Letterie, 2008; Chakravarty & Scott, 1999; Cowling & Mitchell, 2003; Mushinski, 1999). Furthermore,

Mijid and Bernasek's (2013b) comprehensive study of Type 2 credit rationing that includes discouraged borrowers investigates whether credit rationing is related to gender of small business owners. However, these studies are focused on Type 2 credit rationing and there have not been many studies on Type 1 credit rationing. Thus, the current study fills this gap in the knowledge.

Using the latest Surveys of Small Business Finances (SSBF) data, this paper examines Type 1 credit rationing by gender. More specifically, the paper investigates whether women-owned firms are more likely to be Type 1 rationed and whether there is a bias in the approved loan amount based on a borrower's gender. This is another way to examine whether banks treat women-owned firms differently than men-owned firms.

We first analyzed the probability of Type 1 rationing using a logistic regression model. Our result indicates that women-owned firms do not have a higher probability of being Type 1 rationed than men-owned firms. Second, we examined the loan amount granted as a percentage of loan amount requested and found that women owners do receive significantly higher loan in a percentage term as compared to men-owned firms. To check the robustness of the results, we included interaction terms and used separate regression models. However, the results are different for less experienced women owners and younger firms. In particular, female entrepreneurs with less experience and newer firms owned by women may encounter difficulties obtaining credit. The findings offer a new insight into the existing literature which needs to be explored further in detail. This is especially important given that recent studies find that newer firms generate more jobs in the economy than existing firms (Haltiwanger, Jarmin, & Miranda, 2013).

2. Literature review on Type 1 rationing

Type 1 credit rationing occurs when a borrower receives a smaller loan than requested (Keeton, 1979) although there is a different variation in definition. For example, the earliest work by Jaffee and Russell (1976) shows that borrowers prefer larger loan amount at the market interest rate. Allen (1987) surveys the credit rationing phenomenon and answers why equilibrium credit rationing exists and its implications on the microeconomic theory of banking firms. She argued that since the price mechanism (interest rates) is ineffective in allocating capital, lenders use non-price elements "such as past experience, reputation, collateral and other forms of borrower self-insurance" (Allen, 1987, p. 2) to decide who gets a loan and how much.

de Mesa and Webb (1992) proved the existence of Type 1 credit rationing as a result of capital market efficiency. They developed a theoretical model in which, even if information was not asymmetric, the equilibrium credit rationing is characterized by the loan size that is well below the bankruptcy level. This is because of limited-liability debt contracts, and lenders' rationing depends on a project's risk. But projects with intermediate risks are the most biased against. Slazak (2011) found a similar result and claimed that credit rationing could be due to a lack of screening devices by banks to evaluate risk of the projects.

There are several other studies that use theoretical models to explain why Type 1 credit rationing occurs. Ardeni and Messori (1996) argued that it is due to unobservable characteristics such as quality of the projects which are unknown to banks. Kjenstad and Su (2015) claimed that the borrowers ask larger loan size to compensate the higher cost of loan, which in turn increases the excess demand.

A related concept to Type 1 credit rationing is "credit ceiling." Fender and Sinclair (2000) define it as lenders' unwillingness "to finance an investment project optimally" (Fender & Sinclair, 2000, p. 236). They showed what determines credit ceiling when there is a credible threat to bankruptcy in which case the contract may be renegotiated.

Freel (2007) examined exclusively Type 1 credit rationing for small innovative firms using 256 UK firms. His results show that small innovative firms are more likely to be Type 1 rationed than their less innovative counterparts. He also found that faster growing firms and older firms are more likely

to be rationed, while larger firms and exporters are less likely to be Type 1 rationed. He concluded that while a little innovation is desirable, too much innovation signals to banks a risky project.

Mijid and Bernasek's (2013a) recent study examined both Type 1 and Type 2 credit rationing using the Blinder–Oaxaca decomposition method (Blinder, 1973; Oaxaca, 1973). They compared minority-owned firms with white-owned firms in the US The study finds 5% gap between minority- and white-owned firms in the probability of being Type 1 credit rationed. Although this gap is small (minority owners have 5% higher probability than white owners), the entire gap is explained by bank discrimination, not any specific firm or owner characteristics such as firms' size or owners' education and experiences.

Finally, Treichel and Scott (2006) used three surveys for the US small firms to examine loan application rates, loan denial rates, and loan amount by gender of the business owners. These surveys were conducted by the National Federation of Independent Business in 1987, 1995, and 2001. They find that women-owned businesses are less likely to apply for a bank loan and if approved, they are more likely to receive a smaller loan. They concluded that the results could be due to omitted variable biases such as ownership control, fear of rejection, and lender–borrower relationship.

Although theoretical models of Type 1 credit rationing are very well developed (Ardeni & Messori, 1996; Kjenstad & Su, 2015; de Mesa & Webb, 1992; Slazak, 2011), there are not many empirical research done in this area except three studies by Freel (2007), Mijid and Bernasek (2013a), and Treichel and Scott (2006). Especially for women-owned firms, there is no study that specifically examined Type 1 rationing phenomenon for women owners. This may be true due to a limited availability of micro-level data. Next sections describe unique methodology and data-set that we use in this study.

3. Methodology and hypotheses

We examine Type 1 credit rationing using two different models and explain in the below specifications of the models. First, we classify borrowers as Type 1 rationed if they received a smaller amount than they requested. We estimate the conditional probability of Type 1 rationing using the following logistic regression model:

$$\Pr(\text{Type 1 Rationed} = 1|x) = \alpha + \beta_0 female + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon \quad (1)$$

where α and β are unknown parameters, *female* is a binary variable indicating gender of a business owner, x_1, x_2, … x_k are explanatory variables relevant to banks' loan approval decisions, and ε is a random error. Subscripts indicate a number of control variables used in the model. Table 1 shows names and descriptions of the variables used in the regression model.

We classify these explanatory variables into six broad categories. Firm-specific characteristics consist of firm size (measured by log of sales and total employment), age, industry, location, and organizational type of a firm and whether the firm is a family-owned firm. These variables are included in the model to control risks associated with a particular firm. Owner-specific characteristics include owner's age, experience, and education as well as gender and race of the owner to control human capital resources and to examine gender/racial[3] bias in lending. Credit worthiness of a borrower is measured by the credit score, bank–borrower relationship, and homeownership to control whether a borrower has good credit history. Finance-specific characteristics consist of log of equity, short- and long-term debt, return on assets, and whether a firm has other credit options available. They are included in the model to control financial strengths of the firm. Terms of the most recent loan applications include loan type, length, interest rate, collateral requirement, and whether the loan has fixed or variable interest rate. We include the terms of the loan to control financial burden to a borrower which is also an important part of the lender's decision about how much loan should be approved. Other variables include a dummy variable indicating year of the survey (see below the Data section).

Table 1. Variable names and descriptions

Names	Descriptions
Dependent variables	
Type 1 rationed	A dummy variable equals to 1 if a firm receives a smaller loan amount than applied
Percent Granted	Percent Granted equals loan amount granted as a percentage of loan amount applied
Independent variables	
A. Characteristics of a firm	
Log (Sales)	Log (Sales) equals natural log of a firm's total sales
FirmAge	FirmAge equals the number of years a firm has been operating
TotalEmpl	TotalEmpl equals number of full time (or equivalent) employees
Type	A categorical variable equals to 1 if type of a firm S Corporation, 2 if it is C corporation, 3 if it is Partnership and 4 if it is Proprietorship (Note: the only difference between S and C corporations is the tax code; income from C corporations are taxed twice.)
FamOwned	A dummy variable equals to 1 if a firm is owned by members of the same family
MSA	A dummy variable equals to 1 if a firm is located in a Metropolitan State Area
Industry	A categorical variable equals to 1 if a firm is in the Services industry, 2 if it is in the Retail industry, 3 otherwise
B. Characteristics of an owner	
Experience	Experience equals to the principal owner's experience, in years
OwnerAge	OwnerAge equals to age of the principal owner, in years
Education	A categorical variable equals to 1 if the owner has a college degree, 2 if he/she has some college, 3 if he/she is high school graduate
Female	A dummy variable equals to 1 if an owner is a woman, 0 otherwise
Minority	A dummy variable equals to 1 if an owner is minority, 0 otherwise
C. Creditworthiness of a borrower	
CredScore	A categorical variable equals to 1 if a firm's D&B credit score is 0–10, 2 if it is 11–25, 3 if it is 26–50, 4 if it is 51–75, 5 if it is 76–90 and 6 if it is 91–100: 1-most risky and 6 is least risky
Relationship	Relationship equals a number of months a firm conducted business with a primary financial institution
OwnsHome	A dummy variable equals to 1 if a borrower owns home or primary residence
D. Characteristics of finances	
Log (Equity)	Log (Equity) equals natural log of a firm's equity capital
ROA	ROA is Return on Assets and equals to total profit divided by total assets
Long-TermDebt	Long-TermDebt equals to Total long-term loans divided by total assets
Short-TermDebt	Short-TermDebt equals to Total short-term obligations divided by total assets
AltCredit	A dummy variable equals to 1 if a firm has an alternative credit available such as credit cards and trade credit, 0 otherwise
E. Terms of most recent loan	
Loanlength	LoanLength equals a number of months the loan has to be repaid
LoanType	A categorical variable equals to 1—line of credit, 2—capital lease, 3—mortgage, 4—vehicle, 5—equipment, 6—other loans
Interest rate	Interest rate equals the rate of interest for the most recent loan granted
FixedRate	A dummy variable equals to 1 if the loan has a fixed interest rate, 0 otherwise
ReqColla	A dummy variable equals to 1 if the most recent loan requires a collateral
F. Other characteristics	
The 1998 SSBF	A dummy variable equals to 1 indicating the 1998 SSBF, 0 for the 2003 SSBF.

Then we test the following hypothesis using the estimated coefficient for *female* dummy variable after controlling all relevant variables available in the data[4].

Hypothesis 1: Female business owners face a higher probability of Type 1 rationing than men.

In addition, we use a binary-dependent variable that includes Type 2 rationing (Type 1 with Type 2 is a dummy variable equals to 1 if a firm either is denied for a loan or receives smaller loan amount than requested). Since Type 2 rationed borrowers receive zero dollar amount, we use this dependent variable to check the robustness of the results. We also use the same regression model with interaction terms: gender dummy variable interacted with other firm-specific characteristics such as log of sales and equity, age of a firm, total employment, industry, whether the owner is minority. Lastly, we run separate regressions for newer vs. older firms and less experienced owners vs. more experienced ones.

Second, measuring Type 1 credit rationing in this way is somewhat subjective. Borrowers who receive only a few hundred dollars less than requested are treated the same as borrowers who receive a few thousand dollars less. Thus, we use the second approach to investigate whether or not there exists a bias against women-owned firms in the fraction of approved loan amount. We calculate the amount of loan granted as a percentage of the loan amount requested.

$$\text{Percent Granted} = \frac{\text{Loan Granted}}{\text{Loan Applied}} \tag{2}$$

Then we estimate the percentage of loan amount granted using the ordinary least squares (OLS) method with the same explanatory variables (shown in Table 1) and gender dummy variable (with and without interaction terms).

$$\text{Percent Granted} = \alpha + \beta_0 female + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon \tag{3}$$

Using the estimated coefficient for *female*, we then test the following hypothesis:

Hypothesis 2: The size of loans granted in a percentage term is lower for female-owned businesses.

While Hypothesis 1 tests whether women owners are more likely to receive smaller loan amount, Hypothesis 2 tests whether women owners receive significantly lower amount than they requested. We treat these two hypotheses completely separate because women may be more likely to be Type 1 rationed but the loan amount may not be significantly smaller. Conversely, even if we find women owners are not likely to be rationed in general, it does not necessarily mean that those who are rationed does not receive significantly lower amount. For example, let's say 100 women and 100 men applied for a loan and 20% of women and men are equally likely to receive smaller loan. Out of those 20 women and 20 men, we want to know who receives significantly smaller loan in percentage term. Thus, the two hypotheses would tell us two different stories about whether women owners receive smaller loan than they requested as compared to men.

4. Data and descriptive statistics

The study uses the 1998 and 2003 SSBF which can be downloaded from the Federal Reserve Board of Governors website[5]. There are over 6,300 firm-level data with one owner who owns more 50% of the company in these two surveys combined. This is the largest data-set available to public that represents nationally representative sample of small businesses in the US with less than 500 employees. The SSBF is very rich data-set that contains detailed information about the firm, the owner(s), their finances, most recent loan applications, balance sheet and income statement data, and financial institutions. For this reason, the SSBF is most suitable data for this study because the combined data-set gives us a greater number of firms that are Type 1 rationed and allows us to make comparison between women- and men-owned firms.

Data were collected through two stage processes; the selected firms were interviewed first by phone to verify their address, a contact person, and eligibility criteria (for example, non-profit organizations were not eligible) and they were sent computer-assisted questionnaire[6]. Some information in the

Table 2. Descriptive statistics of variables used in the regression models

	All firms		Men-owned firms		Women-owned firms	
Variable	**Mean**	***N***	**Mean**	***N***	**Mean**	***N***
Log (sales)	11.98	6,221	12.20	4,671	11.36	1,550
Firm age, years	13.8	6,302	14.6	4,731	11.7	1,571
Total employment	8.1	6,302	8.8	4,731	6.1	1,571
Proprietorship, %	51	6,302	50	4,731	54	1,571
Partnership, %	5	6,302	5	4,731	6	1,571
C corporation, %	17	6,302	18	4,731	15	1,571
S corporation, %	27	6,302	27	4,731	24	1,571
MSA, %	82	6,302	81	4,731	82	1,571
Retail industry, %	18	6,302	16	4,731	22	1,571
Services industry, %	45	6,302	43	4,731	53	1,571
Experience, years	18.7	6,302	20.0	4,731	15.3	1,571
Owner age, years	50.7	6,302	51.0	4,731	49.7	1,571
High school, %	24	6,302	23	4,731	24	1,571
College, %	17	6,302	17	4,731	19	1,571
High educ., %	59	6,302	60	4,731	57	1,571
Female, %	25	6,302	0	4,731	100	1,571
Minority, %	15	6,302	14	4,731	16	1,571
CredScore1 (most risky), %	7.6	6,280	8.1	4,717	6.0	1,563
CredScore2, %	20.4	6,280	20.3	4,717	20.9	1,563
CredScore3, %	28.9	6,280	27.4	4,717	33.3	1,563
CredScore4, %	23.7	6,280	23.8	4,717	23.1	1,563
CredScore5, %	13.6	6,280	14.1	4,717	12.4	1,563
CredScore6 (least risky), %	5.8	6,280	6.3	4,717	4.4	1,563
Owns home, %	88	6,302	88	4,731	88	1,571
Log (equity)	10.54	5,034	10.76	3,805	9.94	1,229
Return on assets	26.3	6,302	32.7	4,731	9.1	1,571
Long-term debt	1.2	6,302	1.2	4,731	1.3	1,571
Short-term debt	0.7	6,302	0.8	4,731	0.6	1,571
Alternate credit, %	86	6,302	87	4,731	82	1,571
Loan length, months	55.1	1,789	54.34	1,452	57.68	337
Loan Type 1 (line of cred), %	51.2	2,103	51.5	1,677	50.0	426
Loan Type 2 (lease), %	3.0	2,103	3.2	1,677	2.4	426
Loan Type 3 (mortgage), %	10.0	2,103	9.7	1,677	11.0	426
Loan Type 4 (vehicle), %	12.1	2,103	12.3	1,677	11.5	426
Loan Type 5 (equipment), %	13.2	2,103	12.9	1,677	14.5	426
Loan Type 6 (other), %	10.5	2,103	10.4	1,677	10.6	426
Interest rate, %	8.9	4,914	8.9	4,191	8.8	723
Fixed rate, %	64	1,850	62	1,501	71	349
Requires collateral, %	53	1,850	55	1,501	45	349
Relationship, months	113.3	3,549	114.9	2,745	108.6	804
Family-owned firms, %	92	6,302	91	4,731	94	1,571
The 1998 SSBF, %	55.3	6,302	54.5	4,731	57.7	1,571
The 2003 SSBF, %	44.7	6,302	45.5	4,731	42.3	1,571

Sources: The 1998 and 2003 Surveys of Small Business Finances (SSBF).

data-set such as balance sheet data reflects the end-of-the-year snapshot, while other information such as questions related to the most recent loan applications are retrospective data about their experiences on the loan applied within three years. The survey data were collected every five years starting 1987. The 2003 SSBF is the last survey and the most recent available information[7]. Although the 1987 SSBF is the first survey which was conducted in 1988–1989, not all information was collected for the 1987 and 1993 SSBF. For example, the 1987 SSBF does not have firm owners' demographic information such as education, experience, and age. It also does not have information about the amount of loan applied. Similarly, both the 1987 and 1993 surveys did not ask whether the principal owner owns their home and firm's credit score. Therefore, we were unable to use the 1987 and 1993 surveys in our analysis but used them for the robustness check.

Table 2 shows descriptive statistics of relevant variables used in the regression models. There are 1,571 women-owned firms in the combined data-set, which is 25% of the sample. We define women-owned firms if the principal owner owns more than 50% of the company. From Table 2, we can see women-owned firms are smaller (in terms of number of employees, sales, and equity) and younger (11.7 years in business, on average), and more concentrated in services (53%) and retail (22%) industries than men-owned firms. They are more likely to be formed as a sole-proprietorship (54%) and less likely to be a C-Corporation (24%). Women owners have, on average, significantly less experience (15 years) than men (20 years).

Sixteen percent of women owners are from minority group. Another striking difference is that the return of assets (ROA) for women-owned firms is significantly lower (9%) than men-owned firms (33%). For their most recent loan applications, 71% of women obtained a fixed rate loan while 62% men had a fixed rate loan. Forty-five percent of the loan requires collateral for women; however for men, this number is 55%. Women owners, on average, had relationship with their financial institutions 109 months while men had 115 months relationships at the time of their applications.

5. Results

First, we described below the results of the two econometric models that include all available information. Table 3 displays logistic regression results for probability of Type 1 rationing as well as OLS estimates for fraction of loan approved. For Type 1 credit rationing model (Equation 1), negative coefficients indicate that the estimated coefficient would reduce the probability of being Type 1 rationing whereas positive coefficients indicate the opposite.

Our results showed that the coefficient for *female* dummy variable is positive but statistically insignificant. This means women-owned firms do not have a higher probability of Type 1 rationing. This result was consistent with previous research findings on Type 2 credit rationing, which showed women-owned firms' loan denial rate could be explained by firm and owner characteristics other than gender of the owner (Blanchflower et al., 2003; Cavalluzzo & Wolken, 2005; Mijid & Bernasek, 2013b; Mitchell & Pearce, 2005; Robb et al., 2002). In this case, the other characteristics that decrease the probability of Type 1 credit rationing were higher sales, type of a firm as a partnership, a family-owned firm, and a fixed interest rate on a loan. On the other hand, the coefficients that increase the probability (positive and statistically significant) are an S-Corporation (a limited liability company), a Metropolitan State Area as a location, credit scores, equity, an owner's education (college degree), and owner's race as an ethnic minority.

Second, for Percent Granted model (Equation 3), we found a positive and statistically significant coefficient (at the 5% level) for the *female* variable, which indicates that the fraction of an approved loan amount was higher if an owner is a woman. This was completely opposite of what we expected. Nevertheless, it highlights a unique contribution of our Type 1 credit rationing model. Among those who are rationed, women indeed receive a higher loan in percentage term than men do. The result is also may be due to the fact that women owners apply for smaller loans than men, on average. To

Table 3. Regression results of Type 1 rationing

Independent variables	Type 1 credit rationing		Percent Granted	
	Estimate	Standard error	Estimate	Standard error
Intercept	−3.690	1.747**	0.533	0.356
Log (sales)	−0.234	0.117**	0.077	0.026***
FirmAge	−0.017	0.018	−0.004	0.004
TotalEmpl	−0.008	0.007	0.000	0.001
Type-S corporation	0.501	0.240**	−0.067	0.047
Type-C corporation	0.278	0.271	−0.094	0.050*
Type-Partnership	−1.008	0.532*	0.219	0.098**
MSA	0.547	0.323*	0.025	0.060
Industry-services	0.147	0.173	0.060	0.037*
Industry-retail	0.113	0.196	−0.111	0.044***
Experience	0.004	0.017	−0.004	0.003
OwnerAge	0.006	0.015	−0.006	0.003**
Educ—college degree	−0.154	0.165	0.029	0.030
Educ—some college	0.447	0.198**	−0.058	0.041
Female	0.014	0.311	0.116	0.060**
Minority	0.855	0.305**	0.044	0.071
CredScore1	0.929	0.330**	−0.278	0.060***
CredScore2	0.922	0.309**	−0.029	0.057
CredScore3	−0.400	0.336	−0.016	0.060
CredScore4	0.569	0.295**	−0.006	0.055
CredScore5	−0.151	0.387	−0.017	0.074
OwnsHome	0.027	0.408	−0.021	0.073
Log (equity)	0.203	0.110*	−0.049	0.025**
ROA	0.013	0.053	0.010	0.017
Long-TermDebt	0.507	0.553	−0.246	0.115**
Short-TermDebt	1.181	0.766	−0.192	0.141
Relationship	0.002	0.001	0.001	0.000***
FamOwned	−0.817	0.378**	0.176	0.081**
AltCredit	0.706	0.670	0.272	0.147*
LoanLength	0.001	0.002	0.001	0.000
Loantype (LOC)	0.205	0.484	−0.293	0.080***
Loantype (lease)	−2.493	2.163	0.265	0.325
Loantype (mortgage)	0.798	0.538	0.032	0.083
Loantype (vehicle)	0.565	0.515	0.176	0.085**
Loantype (equipment)	0.496	0.524	−0.088	0.087
Interest rate	0.004	0.046	−0.026	0.009***
FixedRate	−0.655	0.274**	0.070	0.054
ReqCollateral	0.118	0.254	0.104	0.043**
The 1998 SSBF	−0.072	0.144	−0.013	0.032
Sample size	1,358		90	
Pearson χ^2/DF	1.1279		1.7647	
AIC	669.383		39.178	

***Level of significance at 1%.

**Level of significance at 5%.

*Level of significance at 10%.

put it differently, men owners are subject to Type 1 rationing since they applied for larger loans, on average, although they have larger assets and employ more workers, which confirms Kjenstad and Su's (2015) arguments.

Other factors that increase the fraction of loans approved include log of sales, the type of a firm as a partnership, services industry, length of relationship with their institution, family-owned businesses, alternate credit availability, a type of a loan as vehicle loan, and required collateral. Conversely, we found negative and statistically significant coefficients for the type a firm as C-corporation, retail industry, credit score 1, equity, long-term debt, owner's age, type of a loan as line of credit, and the interest rate. The remaining coefficients were statistically not significant.

The results of the two models suggest that we reject two hypotheses. More specifically, we found women business owners do not have a higher probability of Type 1 rationing compared to men. Women owners do not receive a smaller percentage of their loan approved either. The probability of Type 1 rationing and the fraction of the loan amount approved are explained by factors other than gender of the business owner, such as sales, equity, credit score, organizational type of firms, and whether it is a family-owned firm.

5.1. Robustness check

We ran the two regression models with interaction terms to check the robustness of the results. These regressions include female dummy variable interacted with age of a firm, log of sales, total number of employees, industry, log of equity, and minority dummy variable. Although results are not reported[8] here, they were consistent with what we found in Table 3. Results with interaction terms showed that women-owned firms do not have a higher probability of being Type 1 rationed, nor received a smaller fraction of the loan approved. The results of Type 1 logistic regressions that include Type 2 indicated the same results[9].

In addition to running Equations 1 and 3 with interaction terms, we looked at younger firms (less than 12 years old, which is the median age for female-owned firms) and less experienced owners (less than 17 years of experience, which is the median for women business owners). Table 4 shows results for the Percent Granted for younger (newer) firms and less experienced owners. It indicates that the coefficient for female-owned firms was negative and statistically significant at 1% level, which means newer firms owned by women receive a significantly lower loan amount approved in percentage term than newer male-owned firms. Furthermore, our results for the Percent Granted model for less experienced owners in Table 4 showed that the coefficient for female dummy variable was also negative and statistically significant at 5% level. This means less experienced women owners receive significantly lower loan amount approved compared to their less experienced men.

We acknowledge that the sample size of the results reported in Table 4 is very small when we look at narrower subsets of women-owned businesses, even though the combined data used in this study are the largest data-set available. That's because Type 1 credit rationing occurs relatively less frequent than the Type 2 credit rationing. However, it is important to include these results in the analysis because they indeed point out two interesting arguments. These results suggest that we need to distinguish which female-owned firms face difficulty in access to credit and why. Our results indicate that although female-owned firms in general do not face a higher probability of Type 1 rationing, certain female owners do receive significantly smaller loan approved compared to their male-owned counterparts. Again, these findings are important and interesting because

> ... inappropriate reporting of research findings may exacerbate the problem and result in misallocation of society's resources. Worse, if women business owners are (possibly erroneously) informed that banks discriminate against them, they may well avoid lending institutions and forego growth opportunities. (Haines, Orser, & Riding, 1999, p. 305)

Table 4. The OLS regression results for young firms and less experienced owners

	Young firms		Less experienced owners	
	Estimate	**Standard error**	**Estimate**	**Standard error**
Intercept	−0.788	0.284***	−0.055	0.272
Log (sales)	0.021	0.027	0.046	0.018***
FirmAge	−0.043	0.008***	0.002	0.003
TotalEmpl	−0.001	0.001	−0.006	0.001***
Type-S corporation	0.126	0.060**	0.020	0.048
Type-C corporation	−0.035	0.068	0.223	0.097**
Type-Partnership	0.183	0.148	−0.211	0.133
MSA	0.285	0.078***	−0.078	0.047*
Industry-services	0.183	0.052***	0.123	0.026***
Industry-retail	−0.168	0.048***	−0.102	0.042**
Female	−0.324	0.052***	−0.052	0.027***
Minority	−0.233	0.075***	0.172	0.066***
Credscore1	0.044	0.109	−0.776	0.119***
Credscore2	0.194	0.071***	−0.253	0.058***
Credscore3	−0.052	0.065	−0.341	0.065***
Credscore4	−0.167	0.092*	−0.460	0.074***
OwnsHome	−0.193	0.085**	0.326	0.128***
Log (equity)	0.072	0.029***	0.063	0.021***
ROA	0.163	0.025***	−0.009	0.014
Long-TermDebt	−0.053	0.125	0.382	0.113***
Short-TermDebt	−0.179	0.115	0.320	0.197*
Relationship	0.001	0.000**	0.001	0.000***
FamOwned	0.748	0.126***	0.011	0.079
AltCredit	0.028	0.086	−0.274	0.073***
LoanLength	0.000	0.000	0.001	0.000***
Loantype (LOC)	−0.314	0.100***	−0.382	0.082***
Loantype (Lease)	0.332	0.318	−0.220	0.204
Loantype (Mortgage)	0.287	0.080***	0.031	0.087
Loantype (Vehicle)	−0.614	0.139***	0.387	0.076***
Interest rate	0.022	0.007***	0.002	0.009
FixedRate	0.016	0.043	−0.431	0.066***
ReqCollateral	−0.066	0.063	−0.108	0.043***
The 1998 SSBF	0.049	0.035	−0.173	0.036***
Sample size	39		37	
Pearson χ^2/DF	6.5		9.25	
AIC	−35.2617		−71.0003	

***Level of significance at 1%.

**Level of significance at 5%.

*Level of significance at 10%.

Therefore, we suggest further analysis in this area; especially, collecting appropriate data is an important next step for improving status of women in the business world. As argued by Babcock and Laschever (2009), "women don't ask" and don't negotiate. In this situation, it is possible that they do not negotiate with banks and hesitant to ask a higher loan amount especially if they lack necessary

skills/experiences or their firms are newer. This also may be a reason they are discouraged from applying for a loan and have misperceptions about their firms, their ability, and banks' loan approval process (Mijid, 2015).

6. Conclusions

Using data from the 1998 and the 2003 SSBF, this paper examines whether female-owned small businesses in the US face a higher probability of being Type 1 rationed and whether they receive smaller loan amount approved than male-owned firms. This is the largest data-set available to public, which contains broad range of information related to their financing. We found that women small business owners do not face a higher probability of Type 1 rationing than men. This result is consistent with findings in previous studies that examined Type 2 credit rationing (Blanchflower et al., 2003; Cavalluzzo & Wolken, 2005; Cavalluzzo et al., 2002; Mijid & Bernasek, 2013b; Mitchell & Pearce, 2005; Robb et al., 2002).

Our results also indicate women owners do not receive smaller loan amount approved in percentage terms compared to men. In fact, we found the opposite: women owners received significantly higher fraction of their loan amount approved than men. This could be due to the fact that women indeed ask for smaller loan amounts and they may be rationing themselves rather than rationed by banks (Mijid & Bernasek, 2013b). This result also could be explained by the fact that male owners apply for a larger amount of loans. Barber and Odean (2001) called this phenomenon as "men's overconfidence." The result also confirms Kjenstad and Su's (2015) argument that borrowers (in this case, male-owned firms) actually apply for a higher loan amount knowing that lenders ration loan amounts.

Lastly, the results from the robustness check indicate that newer or younger firms owned by women receive significantly smaller fraction of their loan approved when compared to men. In addition, less experienced women also receive lower loan amounts in percentage terms than less experienced men. This result suggests that future research is needed to explore specific-type women-owned businesses, especially newest and smallest businesses as well youngest or less experienced owners. This is one of the neglected areas in the literature that needs to be explored more in detail (Marlow, Henry, & Carter, 2009).

There are two practical implications of this study. First, although overt discrimination in lending is illegal and disappeared over time, perceptions and misperceptions of gender discrimination (Haines et al., 1999) still exist. Our findings imply that banks do not have a bias against women owners in general. Thus, encouraging women business owners to apply for credit necessary for growth of their business may solve the issue of their underperformance discussed earlier. Second, government policies to support newer firms, especially women-owned businesses are crucial since such policies would level playing field for women entrepreneurs with less experience. As Haltiwanger et al. (2013) argued, newer firms create more new jobs in the economy than the established businesses.

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Notes
1. See http://www.census.gov/econ/sbo/getsof.html?07women for details.
2. Several research studies in other countries examined female-owned small businesses and their access to credit. To name a few, for the UK female entrepreneurs, see Carter and Rosa (1998), Carter, Shaw, Lam, and Wilson (2007), and Marlow, Hart, Levie, and Shamsul (2012); see Verheul and Thurik (2001) for the Netherlands study; Muravyev, Talavera, and Schäfer (2009) for European countries; Piacentini (2013) for OECD countries; Carrington (2006); Orser, Riding, and Manley (2006) for Canada; and Storey (2004) and Piras, Presbitero, and Rabellotti (2013)

for Barbados, Jamaica, Trinidad ,and Tobago. In this paper, we focus on studies in the US.

3. Because of data limitation, we are unable to include a variable indicating a specific racial group. Instead, we classify them minority- or white-owned firms.
4. Explanatory variables that should be in the model but don't exist in the survey are riskiness of the project, whether the owner is risk-averse or risk-loving, and other variables such as motivation or preferences of the owner.
5. Downloaded from the website: http://www.federalreserve.gov/pubs/oss/oss3/nssbftoc.htm
6. Detailed information about data collection process for each SSBF can be found in a Codebook http://www.federalreserve.gov/pubs/oss/oss3/nssbftoc.htm
7. Because of the budgetary problem, the Fed no longer collects and provides this survey data. In addition, the 2008 GAO report indicates that such voluntary data collection has a limited usefulness for assessing discrimination since it is collected from borrowers, not from lenders. Nevertheless, the data in the SSBF reveal important detailed information about firms, owners, and their finances.
8. Results of six regression models with interaction terms are available upon request.
9. These results are not reported here but available upon request.

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